



# Flora from the *restingas* of Santa Isabel Biological Reserve, northern coast of Sergipe state, Brazil

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**Abstract:** The current study presents a list of angiosperm species collected in *restinga* areas of Santa Isabel Biological Reserve, in the northern coast of Sergipe state. We gathered a preliminary floristic list using herbarium records, and subsequently supplemented it by performing new field samplings. The results showed considerable richness and comprised 260 species, 184 genera and 78 families. Forty-seven out of the 260 species are new records to Sergipe *restingas*. Fabaceae (28 species), Cyperaceae (21 species) and Rubiaceae and Poaceae (12 species) were the most representative families. *Rhynchospora* Vahl (six species), *Polygala* L. (five species) and *Byrsonima* Rich.ex Kunth, *Cuphea* P.Browne, *Cyperus* L. and *Utricularia* L. (four species) were the most speciose genera. The herbs were the most frequent habit (122 species or 47% of the total).

**Key words:** conservation units, coastal plain, floristic inventory

## INTRODUCTION

Brazilian *restingas* lie on sediments deposited in the coastal plain during the Neogene period, and comprise vegetation closely related to the substrate as well as physiographic conditions (Rizzini 1997). This heterogeneous vegetation (Cabral-Freire and Monteiro 1993) covers sand dunes and shows different phytophysognomies. *Restingas* encompass an environmental gradient containing vegetation types ranging from herbaceous communities near to beaches to closed woody formations on the leeward side of dune ridges (Oliveira-Filho and Carvalho 1993). The flora on marine coastal plains originates from the Atlantic rainforest (*Mata Atlântica*) along the Brazilian east coast (Rizzini 1997; Scarano 2002). Despite the *restingas* are found within the *Mata Atlântica* biome (IBGE 2004), species

from other biomes such as the *Caatinga* can also be found within several *restinga* phytophysognomies (Freire 1990).

The high diversity of *restinga* vegetation is recorded in several floristic inventories conducted along the Brazilian coast, such as those from the the states of Rio Grande do Sul (Rambo 1954), Santa Catarina (Reitz 1961), Rio de Janeiro (Pereira and Araujo 2000), Espírito Santo (Pereira and Araujo 2000), São Paulo (Martins et al. 2008), Pernambuco (Zickel et al. 2007), Amapá and Pará (Amaral et al. 2008), Ceará (Santos-Filho et al. 2011), Bahia (Gomes and Guedes 2014), Sergipe (Oliveira et al. 2014) and Piauí (Santos-Filho et al. 2015). The South and Southeastern regions of Brazil show the biggest number of floristic studies on *restingas* (Zickel et al. 2004).

Despite low, the number of floristic studies on *restingas* of the Northeastern region has increased in the recent years. Among the studies made in Northeastern Brazil, most of papers comes from the state of Pernambuco (e.g. Andrade-Lima 1960; Leite and Andrade 2004; Almeida Jr. et al. 2007; Sacramento et al. 2007; Zickel et al. 2007; Almeida Jr. et al. 2009; Silva et al. 2008; Cantarelli et al. 2012), followed by Bahia (e.g. Pinto et al. 1984; Brito et al. 1993; Queiroz 2007; Menezes et al. 2009; Menezes et al. 2012; Silva and Menezes 2012; Gomes and Guedes 2014), Ceará (Matias and Nunes 2001; Santos-Filho et al. 2011; Castro et al. 2012), Paraíba (Carvalho and Oliveira-Filho 1993; Oliveira-Filho and Carvalho 1993; Pontes and Barbosa 2008) and Rio Grande do Norte (Freire 1990; Almeida Jr. et al. 2006; Almeida Jr. and Zickel 2009). However, few publications involving other states in this region have been found, namely Alagoas (Esteves 1980), Maranhão (Cabral-Freire and Monteiro 1993; Cabral-Freire and Monteiro 1994), Piauí (Santos-Filho et al. 2015) and Sergipe (Oliveira et al. 2014). Thus, it is necessary to encourage studies on this vegetation and

to disseminate information about its species, in order to improve the knowledge on its distribution patterns, endemisms and conservation status.

In this study, we perform a floristic inventory on the *restingas* of the Biological Reserve of Santa Isabel, in northern coast of Sergipe state. This reserve is the only protected area in Sergipe to present *restinga* areas and meet the strict protection requirements according to the Brazilian System of Protected Areas (Brasil 2000).

## MATERIALS AND METHODS

### Study site

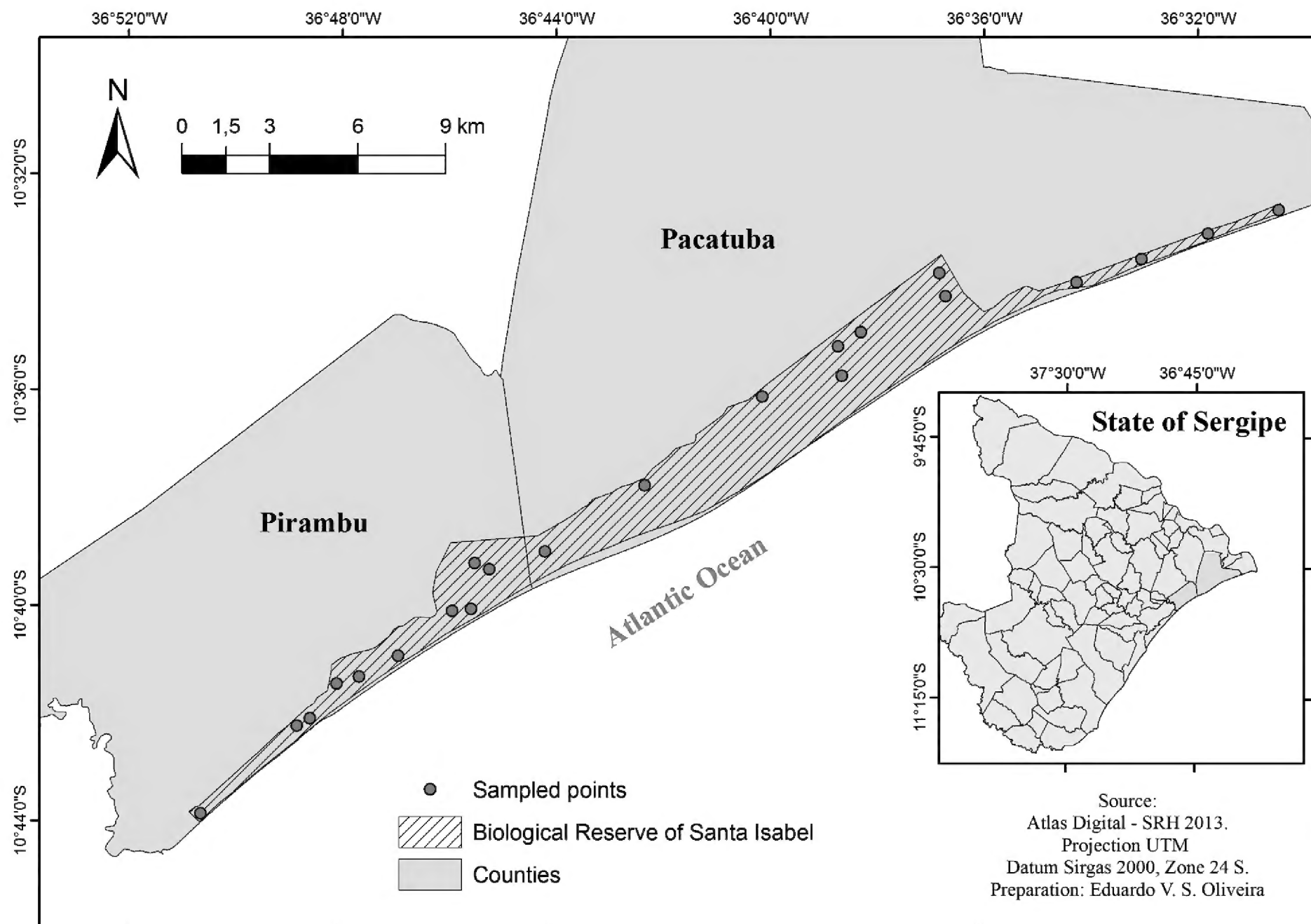
The Biological Reserve of Santa Isabel is limited on the south by mouth of the Japarutuba River, in Pirambu County, and on the north by the mouth of the Funil River (a secondary mouth in São Francisco River), in Pacatuba County. This conservation unit covers 45 km of beaches and has an area of 2,766 ha (Brasil 1988).

The climate in the region—Köppen's As type (Alvares et al. 2013)—shows marked seasonality. The rainy season lasts from March to August, whereas the dry season starts in September and ends in February. The total rainfall ranges from 1,500 to 1,800 mm throughout the year. The mean annual temperature is of approximately 25°C (SEPLAG 2011).

### Data collection and analysis

Initially, we carried out a search for plant species collections made in the *restingas* of Santa Isabel Biological Reserve in the ASE Herbarium of the Federal University of Sergipe (Thiers 2015). For this, we used the *speciesLink* network of the Reference Center on Environmental Information (CRIA 2014). Vouchers from the ASE Herbarium collected in *restingas* of Santa Isabel Biological Reserve were analyzed. Vouchers with incomplete or questionable identification were excluded.

Besides the data already recorded in ASE Herbarium, we improved the floristic list of the Santa Isabel Biological Reserve by performing 42 field trips to the reserve (under ICMBio's SISBIO license number 41647). We sampled 22 points along the entire extension of the protected area, from August, 2012 to May, 2014 (Figure 1). We evaluated the vegetation around each sampling point during the search for fertile specimens (those presenting flowers and/or fruits). We collected and prepared these specimens according to standard techniques (Mori et al. 1989); identified, recorded and incorporated them to the ASE Herbarium. We classified species according to the Angiosperm Phylogeny Group III classification system (Bremer et al. 2009) and checked the nomenclature of species using the Species List of the Brazilian Flora (Lista de Espécies da Flora do Brasil 2014).



**Figure 1.** Angiosperm sampling points in *restingas* of Santa Isabel Biological Reserve in the northern coast of Sergipe state (dots indicate areas where plant collections were done).

RESULTS

Altogether, 260 angiosperms species, distributed among 184 genera and 78 families, were found (Table 1). Nearly 18% of the total number of species (47 species) represents new records for Sergipe *restingas*, considering the recent compilation by Oliveira et al. (2014).

Fabaceae (28 species), Cyperaceae (21), Rubiaceae (12), Poaceae (12) and Myrtaceae (10) were the most representative families (Figure 2). The five most representative families (with 10 or more species) accounted for 31% of all species and 6% of all families. Nearly half of the families (46%) presented just one

**Table 1.** List of the 260 angiosperm species collected in *restingas* of Santa Isabel Biological Reserve, Northern coast of Sergipe. \* = invasive/alien species. + = new occurrence in Sergipe State *restingas* (according to Oliveira et al. 2014). \*\* = data sampling of herbarium ASE.

Family, species	Voucher (ASE)	Habit
<b>Aizoaceae</b>		
<i>Sesuvium portulacastrum</i> (L.) L.	26658	Herb
<b>Alismataceae</b>		
<i>Helanthium tenellum</i> (Martius) Britton <sup>+</sup>	8979**	Herb
<b>Amaranthaceae</b>		
<i>Alternanthera littoralis</i> P.Beauv.	25609	Herb
<b>Anacardiaceae</b>		
<i>Anacardium occidentale</i> L.	29411	Tree
<i>Schinus terebinthifolius</i> Raddi	29117	Tree
<i>Tapirira guianensis</i> Aubl. (Figure 3E)	29215	Tree
<b>Annonaceae</b>		
<i>Annona glabra</i> L. <sup>+</sup>	27514	Shrub
<i>Duguetia gardneriana</i> Mart.	29160	Shrub
<i>Duguetia moricandiana</i> Mart.	29401	Shrub
<i>Xylopia laevigata</i> (Mart.) R.E.Fr.	6489	Shrub
<b>Apocynaceae</b>		
<i>Calotropis procera</i> (Aiton) W.T.Aiton**	7342**	Shrub
<i>Hancornia speciosa</i> Gomes	29405	Tree
<i>Himatanthus bracteatus</i> (A.DC.) Woodson	29212	Tree
<i>Mandevilla moricandiana</i> (A. DC.) Woodson	29166	Climber
<i>Mandevilla scabra</i> (Hoffmanns. ex Roem. & Schult.) K.Schum.	25598	Climber
<i>Temnadenia odorifera</i> (Vell.) J.F.Morales	29177	Climber
<b>Araceae</b>		
<i>Anthurium affine</i> Schott	30590	Herb
<i>Philodendron acutatum</i> Schott	29139	Epiphyte
<i>Philodendron imbe</i> Schott ex Kunth.	29581	Epiphyte
<b>Araliaceae</b>		
<i>Hydrocotyle bonariensis</i> Lam.	25607	Herb
<b>Arecaceae</b>		
<i>Allagoptera arenaria</i> (Gomes) Kuntze	30592	Shrub
<i>Syagrus coronata</i> (Mart.) Becc.	25595	Shrub
<b>Asteraceae</b>		
<i>Ageratum conyzoides</i> L.	30857	Herb
<i>Conocliniopsis prasiifolia</i> (DC.) R.M.King & H.Rob.	25594	Herb
<i>Conyza bonariensis</i> (L.) Cronquist <sup>+</sup>	30586	Herb
<i>Elephantopus hirtiflorus</i> DC.	29153	Herb
<i>Emilia sonchifolia</i> (L.) DC. ex Wight <sup>+</sup>	29438	Herb
<i>Lepidaploa mucronifolia</i> (DC.) H.Rob.	29193	Shrub
<i>Mikania cordifolia</i> (L. f.) Willd. <sup>+</sup>	29148	Herb
<i>Tilesia baccata</i> (L.f.) Pruski	32747	Herb
<b>Balanophoraceae</b>		
<i>Langsdorffia hypogaea</i> Mart. (Figure 3G)	29144	Holoparasite
<b>Bignoniaceae</b>		
<i>Lundia cordata</i> (Vell.) DC.	29165	Climber
<b>Bonnetiaceae</b>		
<i>Bonnetia stricta</i> (Nees) Nees & Mart.	30872	Shrub
<b>Boraginaceae</b>		
<i>Euploca polyphylla</i> (Lehm.) J.I.M.Melo & Semir	25608	Herb

Family, species	Voucher (ASE)	Habit
<b>Bromeliaceae</b>		
<i>Aechmea aquilega</i> (Salisb.) Griseb.	29138	Herb
<i>Aechmea lingulata</i> (L.) Baker	12892**	Herb
<i>Aechmea multiflora</i> L. B. Sm.	29192	Herb
<i>Hohenbergia catingae</i> Ule	29406	Herb
<i>Hohenbergia ridleyi</i> (Baker) Mez	12897**	Herb
<b>Burseraceae</b>		
<i>Protium heptaphyllum</i> (Aublet) Marchand	29146	Tree
<b>Cactaceae</b>		
<i>Cereus fernambucensis</i> Lem.	29082	Herb
<i>Melocactus violaceus</i> Pfeiff.	30075	Herb
<i>Pilosocereus gounellei</i> (F.A.C. Weber) Byles e G.D. Rowley	30469	Shrub
<b>Capparaceae</b>		
<i>Cynophalla flexuosa</i> L. J. Presl.	29113	Shrub
<b>Celastraceae</b>		
<i>Maytenus obtusifolia</i> Mart.	29159	Shrub
<b>Chrysobalanaceae</b>		
<i>Couepia racemosa</i> Benth. ex Hook.f.	7347**	Tree
<i>Chrysobalanus icaco</i> L.	29081	Shrub
<i>Hirtella ciliata</i> Mart. & Zucc.	29220	Shrub
<i>Hirtella gracilipes</i> (Hook.f.) Prance <sup>+</sup>	30575	Shrub
<i>Hirtella racemosa</i> Lam.	29173	Shrub
<i>Licania corniculata</i> Prance	32759	Tree
<i>Licania impressa</i> Prance <sup>+</sup>	32756	Tree
<b>Cleomaceae</b>		
<i>Physostemon rotundifolium</i> Mart. & Zucc. <sup>+</sup>	29088	Herb
<b>Clusiaceae</b>		
<i>Clusia dardanoi</i> G.Mariz & Maguire <sup>+</sup>	29218	Shrub
<i>Symphonia globulifera</i> L.f. (Figure 3L)	29197	Tree
<b>Commelinaceae</b>		
<i>Commelina erecta</i> L.	30862	Herb
<b>Convolvulaceae</b>		
<i>Evolvulus pterocaulon</i> Moric	30568	Herb
<i>Ipomoea asarifolia</i> (Desr.) Roem. & Schult.	29022	Climber
<i>Ipomoea imperati</i> (Vahl) Griseb.	7344**	Climber
<i>Ipomoea pes-caprae</i> (L.) R.Br.	27515	Climber
<i>Jacquemontia montana</i> (Moric.) Meisn.	29094	Climber
<b>Cyperaceae</b>		
<i>Bulbostylis junciformis</i> (Kunth) C.B.Clarke	8333**	Herb
<i>Cyperus haspan</i> L.	27512	Herb
<i>Cyperus hermaphroditus</i> (Jacq.) Standl.	29069	Herb
<i>Cyperus ligularis</i> L.	29095	Herb
<i>Cyperus maritimus</i> Poir.	30853	Herb
<i>Eleocharis equisetoides</i> (Elliott) Torr.	7365**	Herb
<i>Eleocharis filiculmis</i> Kunth	8439**	Herb
<i>Eleocharis geniculata</i> (L.) Roem. & Schult.	30585	Herb
<i>Fimbristylis complanata</i> (Retz.) Koeler Link.	8727**	Herb
<i>Fimbristylis cymosa</i> R.Br.	27506	Herb

Continued



Table 1. Continued.

Family, species	Voucher (ASE)	Habit
<i>Kyllinga odorata</i> Vahl <sup>+</sup>	26660	Herb
<i>Kyllinga vaginata</i> Lam.	7325*	Herb
<i>Pycnus polystachyos</i> (Rottb.) P.Beauv.	29443	Herb
<i>Remirea maritima</i> Aubl.	29122	Herb
<i>Rhynchospora barbata</i> (Vahl) Kunth	8330**	Herb
<i>Rhynchospora cephalotes</i> (L.) Vahl	7392**	Herb
<i>Rhynchospora filiformis</i> Vahl	8440**	Herb
<i>Rhynchospora holoschoenoides</i> (Rich.) Herter	8320**	Herb
<i>Rhynchospora riparia</i> (Nees) Boeckeler	29026	Herb
<i>Rhynchospora tenerrima</i> Nees ex Spreng.	8334**	Herb
<i>Scleria secans</i> (L.) Urb.	8321*	Herb
<b>Dilleniaceae</b>		
<i>Curatella americana</i> L. (Figure 3H)	30047	Tree
<i>Davilla flexuosa</i> A.St.-Hil.	30063	Shrub
<i>Davilla nitida</i> (Vahl) Kubitzki <sup>+</sup>	10330**	Shrub
<i>Tetracera breyniana</i> Schltd.	29151	Shrub
<b>Ebenaceae</b>		
<i>Diospyros gaultheriifolia</i> Mart. ex Miq.	29150	Shrub
<b>Eriocaulaceae</b>		
<i>Actinocephalus ramosus</i> (Wikstr.) Sano	7363**	Herb
<i>Paepalanthus tortilis</i> (Bong.) Mart.	29009	Herb
<b>Erythroxylaceae</b>		
<i>Erythroxylum passerinum</i> Mart.	29167	Tree
<b>Euphorbiaceae</b>		
<i>Cnidosculus urens</i> (L.) Arthur	29602	Shrub
<i>Croton sellowii</i> Baill	29393	Shrub
<i>Euphorbia hirta</i> L.	7339**	Herb
<i>Sapium glandulosum</i> (L.) Morong	29110	Tree
<b>Fabaceae</b>		
<i>Abarema cochliacarpus</i> (Gomes) Barneby & J.W.Grimes <sup>+</sup>	28596**	Tree
<i>Aeschynomene viscidula</i> Michx.	25592	Climber
<i>Andira fraxinifolia</i> Benth.	29184	Tree
<i>Canavalia rosea</i> (Sw.) DC. (Figure 3I)	25611	Climber
<i>Centrosema brasiliannum</i> (L.) Benth. (Figure 3A)	27485	Climber
<i>Centrosema pascuorum</i> Mart. ex Benth.	29024	Climber
<i>Centrosema virginiamun</i> (L.) Benth. <sup>+</sup>	29586	Climber
<i>Chamaecrista flexuosa</i> (L.) Greene	29601	Herb
<i>Chamaecrista hispidula</i> (Vahl) H.S.Irwin & Barneby	29404	Herb
<i>Chamaecrista ramosa</i> (Vogel) H.S.Irwin & Barneby	29398	Herb
<i>Clitoria laurifolia</i> Poir.	29029	Herb
<i>Crotalaria retusa</i> L.	25612	Herb
<i>Crotalaria incana</i> L. <sup>+</sup>	27516	Shrub
<i>Desmodium barbatum</i> (L.) Benth.	25620	Herb
<i>Dioclea violacea</i> Mart. Ex Benth.	29116	Tree
<i>Indigofera sabulicola</i> Benth.	29444	Herb
<i>Inga capitata</i> Desv.	29168	Tree
<i>Inga ciliata</i> C. Presl.	29087	Tree
<i>Inga laurina</i> (Sw.) Willd	29196	Tree
<i>Macroptilium panduratum</i> (Mart. ex Benth.) Maréchal & Baudet	30468	Climber
<i>Mimosa pigra</i> L.	29125	Shrub
<i>Mimosa caesalpiniiifolia</i> Benth.	27500	Tree
<i>Senna splendida</i> (Vogel) H. S. Irwin & Barneby	29109	Shrub
<i>Sesbania virgata</i> (Cav.) Pers. <sup>+</sup>	27518	Shrub
<i>Stylosanthes viscosa</i> (L.) Sw. (Figure 3F)	29588	Herb
<i>Swartzia apetala</i> Raddi	20111**	Tree
<i>Vigna peduncularis</i> (Kunth) Fawc. & Rendle <sup>+</sup>	7396**	Shrub

Family, species	Voucher (ASE)	Habit
<i>Zornia latifolia</i> Sm.	28947**	Shrub
<b>Gentianaceae</b>		
<i>Curtia tenella</i> (Mart.) Cham.	25621	Herb
<i>Schultesia aptera</i> Cham. <sup>+</sup>	29448	Herb
<i>Schultesia guianensis</i> (Aubl.) Malme	25625	Herb
<b>Gesneriaceae</b>		
<i>Codonanthe mattsos-silvae</i> Chautems <sup>+</sup>	32751	Herb
<b>Hernandiaceae</b>		
<i>Sparattanthelium botocudorum</i> Mart.	23955**	Tree
<b>Humiriaceae</b>		
<i>Humiria balsamifera</i> (Aubl.) J.St.-Hil.	29178	Tree
<b>Krameriaceae</b>		
<i>Krameria tomentosa</i> A.St.-Hil.	29409	Shrub
<b>Lamiaceae</b>		
<i>Hypernia salzmännii</i> (Benth.) Harley	29397	Shrub
<i>Hyptis fruticosa</i> Salzm. ex Benth.	30303	Shrub
<i>Marsypianthes chamaedrys</i> (Vahl) Kuntze	30854	Herb
<i>Marsypianthes montana</i> Benth. <sup>+</sup>	27497	Herb
<i>Rhaphiodon echinus</i> Schauer	29070	Climber
<b>Lauraceae</b>		
<i>Cassytha filiformis</i> L.	30858	Holoparasite
<i>Ocotea gardneri</i> (Meisn.) Mez	29171	Tree
<i>Ocotea notata</i> (Nees & C. Martius ex Nees) Mez	10506**	Tree
<b>Lecythidaceae</b>		
<i>Eschweilera ovata</i> (Cambess.) Mart. ex Miers	30874	Tree
<i>Lecythis pisonis</i> Cambess.	30871	Shrub
<b>Lentibulariaceae</b>		
<i>Utricularia foliosa</i> L.	29010	Herb
<i>Utricularia gibba</i> L.	27504	Herb
<i>Utricularia pusilla</i> Vahl	27507	Herb
<i>Utricularia subulata</i> L.	27505	Herb
<b>Loranthaceae</b>		
<i>Psittacanthus dichroos</i> (Mart.) Mart. (Figure 3D)	29135	Hemiparasite
<i>Struthanthus polyrhizus</i> (Mart.) Mart.	29211	Hemiparasite
<i>Struthanthus syringifolius</i> (Mart.) Mart.	29185	Hemiparasite
<b>Lythraceae</b>		
<i>Cuphea carthagenensis</i> (Jacq.) J.Macbr.	25628	Herb
<i>Cuphea flava</i> Spreng	29407	Herb
<i>Cuphea glareosa</i> T.B.Cavalc. <sup>+</sup>	25616	Herb
<i>Cuphea linarioides</i> Cham. & Schltdl. <sup>+</sup>	25617	Herb
<b>Malpighiaceae</b>		
<i>Byrsonima blanchetiana</i> Miq. <sup>+</sup>	32755	Tree
<i>Byrsonima gardneriana</i> A. Juss.	30855	Shrub
<i>Byrsonima sericea</i> DC. (Figure 3B)	29593	Tree
<i>Byrsonima vacciniifolia</i> A.Juss.	7708**	Shrub
<i>Stigmaphyllon paralias</i> A.Juss.	30301	Herb
<b>Malvaceae</b>		
<i>Pavonia humifusa</i> A. St - Hil. (Figure 3K)	29128	Herb
<i>Sida angustissima</i> A.St.-Hil. <sup>+</sup>	30065	Herb
<i>Sida ciliaris</i> L. <sup>+</sup>	29011	Herb
<i>Sida spinosa</i> L. <sup>+</sup>	29585	Herb
<i>Waltheria indica</i> L.	25610	Herb
<b>Melastomataceae</b>		
<i>Clidemia hirta</i> (L.) D.Don	29201	Shrub
<i>Comolia ovalifolia</i> (DC.) Triana	26664	Shrub
<i>Miconia amoena</i> Triana	30470	Shrub
<i>Miconia ciliata</i> (Rich.) DC.	29205	Shrub
<i>Mouriri pusa</i> Gardner	30578	Tree
<i>Pterolepis glomerata</i> (Rottb.) Miq. <sup>+</sup>	27503	Shrub
<i>Pterolepis trichotoma</i> (Rottb.) Cogn.	25619	Shrub

Continued

Table 1. Continued.

Family, species	Voucher (ASE)	Habit
<b>Menyanthaceae</b>		
<i>Nymphoides indica</i> (L.) Kuntze	25613	Herb
<b>Moraceae</b>		
<i>Brosimum gaudichaudii</i> Trécul	20114**	Tree
<i>Ficus clusiifolia</i> Schott <sup>+</sup>	29145	Tree
<b>Myrtaceae</b>		
<i>Calycolpus legrandii</i> Mattos	30300	Tree
<i>Campomanesia dichotoma</i> (O.Berg) Mattos	27491	Tree
<i>Eugenia costatifructa</i> Mazine	29203	Shrub
<i>Eugenia puniceifolia</i> (Kunth) DC.	30297	Shrub
<i>Marlierea excoriata</i> Mart.	30869	Tree
<i>Myrcia decorticans</i> DC.	6486	Tree
<i>Myrcia guianensis</i> (Aubl.) DC.	30356	Tree
<i>Myrcia ovina</i> Proença & Landim <sup>+</sup>	30040	Shrub
<i>Psidium guajava</i> L.	30583	Tree
<i>Psidium oligospermum</i> Mart. ex DC.	27482	Tree
<b>Nyctaginaceae</b>		
<i>Guapira opposita</i> Vell. <sup>+</sup>	29200	Tree
<i>Guapira pernambucensis</i> (Casar.) Lundell	30588	Tree
<i>Neea theifera</i> Oerst.	7360**	Shrub
<i>Pisonia cordifolia</i> Mart. ex J.A.Schmidt <sup>+</sup>	30863	Tree
<b>Nymphaeaceae</b>		
<i>Nymphaea pulchella</i> DC. <sup>+</sup> (Figure 3C)	29013	Herb
<b>Ochnaceae</b>		
<i>Ouratea cuspidata</i> St. Hil.	29181	Tree
<i>Sauvagesia erecta</i> L.	26667	Herb
<i>Sauvagesia tenella</i> Lam. <sup>+</sup>	25623	Herb
<b>Olacaceae</b>		
<i>Ximenia americana</i> L.	32757	Tree
<b>Onagraceae</b>		
<i>Ludwigia octovalvis</i> (Jacq.) P.H.Raven	30475	Herb
<b>Orchidaceae</b>		
<i>Vanilla bahiana</i> Hoehne	27508	Epiphyte
<b>Passifloraceae</b>		
<i>Passiflora foetida</i> L.	27484	Climber
<i>Passiflora misera</i> Kunh	29129	Climber
<i>Passiflora silvestris</i> Veel.	29032	Climber
<i>Piriqueta duarteana</i> (Cambess.) Urb.var. <i>duarteana</i>	29396	Herb
<i>Piriqueta viscosa</i> Griseb.	7340**	Herb
<i>Turnera calyptrocarpa</i> Urb. <sup>+</sup>	29030	Herb
<i>Turnera pumilea</i> L. var. <i>pumilea</i>	7354**	Herb
<b>Peraceae</b>		
<i>Chaetocarpus echinocarpus</i> (Baill.) Ducke <sup>+</sup>	30302	Tree
<i>Pera glabrata</i> (Schott) Poepp. ex Baill.	29214	Tree
<b>Plantaginaceae</b>		
<i>Bacopa monnieri</i> (L.) Wettst. <sup>+</sup> (Figure 3J)	29454	Herb
<i>Scoparia dulcis</i> L.	30294	Herb
<b>Poaceae</b>		
<i>Andropogon selloanus</i> (Hack.) Hack.	29399	Herb
<i>Dactyloctenium aegyptium</i> (L.) Willd. <sup>+</sup>	29418	Herb
<i>Eragrostis bahiensis</i> Schrad. ex Schult. <sup>+</sup>	11521**	Herb
<i>Eragrostis ciliaris</i> (L.)	30304	Herb
<i>Eragrostis maypurensis</i> (Kunth) Steud. <sup>+</sup>	30357	Herb
<i>Lasiacis ligulata</i> Hitchc. & Chase <sup>+</sup>	29140	Herb
<i>Panicum racemosum</i> (P. Beauv.) Spreng.	12896**	Herb
<i>Panicum trichoides</i> Sw. <sup>+</sup>	29124	Herb
<i>Paspalum maritimum</i> Trin.	30861	Herb
<i>Paspalum vaginatum</i> Sw.	12887**	Herb
<i>Setaria tenax</i> (Rich.) Desv. <sup>+</sup>	30584	Herb

Family, species	Voucher (ASE)	Habit
<i>Sporobulos virginicus</i> (L.) Kunth	29450	Herb
<b>Polygalaceae</b>		
<i>Asemeia violacea</i> (Aubl.) J.F.B. Pastore & J.R.Abbott <sup>+</sup>	29066	Herb
<i>Polygala appendiculata</i> Vell. <sup>+</sup>	25624	Herb
<i>Polygala boliviensis</i> A.W.Benn. <sup>+</sup>	29020	Herb
<i>Polygala cyparissias</i> A.St.-Hil. & Moq.	30053	Herb
<i>Polygala trichosperma</i> Jacq.	29073	Herb
<i>Polygala violacea</i> Aubl.	30352	Herb
<b>Polygonaceae</b>		
<i>Coccoloba laevis</i> Casar.	29155	Shrub
<b>Pontederiaceae</b>		
<i>Eichhornia crassipes</i> (Mart.) Solms	29012	Herb
<b>Portulacaceae</b>		
<i>Portulaca halimoides</i> L.	29413	Herb
<b>Rhamnaceae</b>		
<i>Ziziphus undulata</i> Reissek	29089	Tree
<b>Rubiaceae</b>		
<i>Borreria capitata</i> (Ruiz & Pav.) DC.	29402	Herb
<i>Borreria verticillata</i> (L.) G.Mey.	29394	Herb
<i>Chiococca alba</i> (L.) Hitchc.	7376**	Shrub
<i>Cordia concolor</i> (Cham.) Kuntze	30868	Shrub
<i>Diodella apiculata</i> (Willd. ex Roem. & Schult.) Delprete <sup>+</sup>	29403	Herb
<i>Diodella radula</i> (Willd. ex Roem. & Schult.) Delprete	7356**	Herb
<i>Mitracarpus frigidus</i> (Willd. ex Roem. & Schult.) K.Schum.	7395**	Herb
<i>Mitracarpus hirtus</i> (L.) DC.	29584	Herb
<i>Psychotria hoffmannseggiana</i> (Willd. ex Schult.) Müll.Arg.	29149	Shrub
<i>Richardia grandiflora</i> (Cham. & Schltdl.) Steud.	29412	Herb
<i>Tocoyena bullata</i> (Vell.) Mart.	30858	Tree
<i>Tocoyena formosa</i> (Cham. & Schltdl.) K.Schum.	29031	Tree
<b>Salicaceae</b>		
<i>Casearia sylvestris</i> Sw.	7373**	Shrub
<b>Santalaceae</b>		
<i>Phoradendron quadrangulare</i> (Kunth) Griseb.	7367**	Hemiparasite
<i>Phoradendron strongyloclados</i> Eichler	29161	Hemiparasite
<b>Sapindaceae</b>		
<i>Cupania racemosa</i> (Vell.) Radlk.	29157	Tree
<i>Paullinia pinnata</i> L. <sup>+</sup>	32750	Shrub
<b>Sapotaceae</b>		
<i>Manilkara rufula</i> (Miq.) H.J.Lam	29182	Shrub
<i>Manilkara salzmännii</i> (A.DC.) H.J.Lam	32753	Shrub
<i>Pouteria venosa</i> (Mart.) Baehni	30473	Tree
<b>Simaroubaceae</b>		
<i>Simaba floribunda</i> A.St.-Hil. <sup>+</sup>	29183	Tree
<b>Smilacaceae</b>		
<i>Smilax rufescens</i> Griseb.	29190	Climber
<b>Solanaceae</b>		
<i>Solanum paludosum</i> Moric.	26663	Shrub
<i>Solanum paniculatum</i> L.	29191	Shrub
<i>Solanum stipulaceum</i> Willd. ex Roem. & Schult.	7372**	Shrub
<i>Solanum polytrichum</i> Moric.	29207	Shrub
<b>Trigonaceae</b>		
<i>Trigonia nivea</i> Cambess	29213	Shrub
<b>Typhaceae</b>		
<i>Typha domingensis</i> Pears <sup>+</sup>	29017	Herb

Continued

**Table 1.** Continued.

Family, species	Voucher (ASE)	Habit
<b>Urticaceae</b>		
<i>Cecropia pachystachya</i> Trécul.	29195	Tree
<b>Verbenaceae</b>		
<i>Lantana camara</i> L.	29164	Herb
<i>Lippia alba</i> (Mill.) N.E.Br.	30873	Herb
<i>Stachytarpheta microphylla</i> Walp.	25596	Herb
<b>Violaceae</b>		
<i>Pombalia arenaria</i> (Ule) Paula-Souza	30577	Herb
<i>Pombalia calceolaria</i> (L.) Paula-Souza	29035	Herb

Family, species	Voucher (ASE)	Habit
<b>Vitaceae</b>		
<i>Cissus erosa</i> Rich.	30296	Climber
<b>Xyridaceae</b>		
<i>Xyris jupicai</i> Rich.	26659	Herb

species, which encompasses 13% of the total number of species.

*Rhynchospora* Vahl (6 species), *Polygala* L. (5) and *Byrsonima* Rich.ex Kunth, *Cuphea* P.Browne, *Cyperus* L. and *Utricularia* L. (4) were the most representative genera.

The herbs comprised the most predominant habit (47% of the total number of species) in the *restingas* of Santa Isabel Biological Reserve (122 species), followed by shrubs (58), trees (52), climbers (18), holo and hemiparasites (7) and epiphytes (3).

## DISCUSSION

The number of angiosperm species found in the *restingas* of Santa Isabel Biological Reserve was lower than that found by most studies conducted along the Brazilian coast (Table 2). However, it is noteworthy that these *restingas*, along a 45 km shoreline (corresponding to only 0.6% of the Brazilian coast), shows approximately 16% of the species and 49% of the families so far compiled for the Brazilian *restingas*, according to data from different studies carried out within this formation (Restinga Net 2015). This result reinforces the great plant richness of this protected area and its importance for biodiversity conservation.

Among the most abundant plant families, Fabaceae consistently presents great importance in the *restingas* according to several surveys conducted along the Brazilian coast. Indeed, Fabaceae presents the greatest

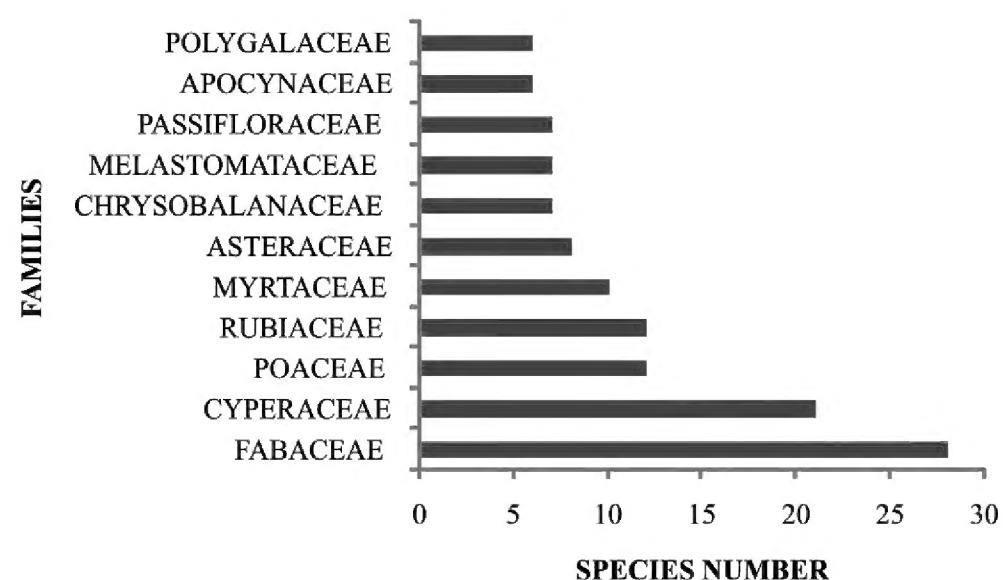
richness in neotropical dry forests (Gentry 1995), and was the most speciose family in studies carried out in the states of North, Northeast and Southeast Brazil, namely Amapá (Amaral et al. 2008), Pará (Bastos et al. 1995; Amaral et al. 2008; Silva et al. 2010), Maranhão (Cabral-Freire and Monteiro 1993), Piauí (Santos-Filho et al. 2015), Ceará (Santos-Filho et al. 2011; Castro et al. 2012), Rio Grande do Norte (Freire 1990; Almeida Jr. and Zickel 2009; Almeida Jr. et al. 2006), Paraíba (Oliveira-Filho and Carvalho 1993; Pontes and Barbosa 2008), Pernambuco (Leite and Andrade 2004), Sergipe (Oliveira et al. 2014), Bahia (Brito et al. 1993; Gomes and Guedes 2014), Espírito Santo (Colodete and Pereira 2007; Leite et al. 2007) and Rio de Janeiro (Afonso et al. 2007; Lemos et al. 2001; Araujo and Oliveira 1988). Moreover, Fabaceae was one of the most important families listed in inventories conducted in the states of Ceará (Matias and Nunes 2001), Pernambuco (Silva et al. 2008; Sacramento et al. 2007), Alagoas (Medeiros et al. 2010) and Bahia (Queiroz 2007).

It is possible that the ability to biologically fix atmospheric nitrogen through mutualistic relationships

**Table 2.** Results from selected studies on the flora of *restingas* in the Brazilian coast.

Place	No. of Species	No. of Families	Reference
BRAZIL	1.598	158	Restinga Net (2015)*
AP/PA	365	89	Amaral et al.(2008)*
MA	260	76	Cabral-Freire and Monteiro (1993)
PI	363	74	Santos-Filho et al.(2015)*
CE	392	41	Santos-Filho et al.(2011)*
RN	264	78	Freire (1990)
PB	263	68	Oliveira-Filho and Carvalho (1993)
PE	477	95	Zickel et al. (2007)*
PE	187	71	Almeida Jr. et al. (2009)
SE	260	78	This study
SE	831	124	Oliveira et al. (2014)*
BA	934	115	Gomes and Guedes (2014)
ES	749	—	Pereira and Araujo (2000)
RJ	1008	—	Pereira and Araujo (2000)
RJ	379	84	Silva and Oliveira (1989)
SP	611	106	Martins et al. (2008)
SC	851	—	Reitz (1961)*
RS	1072	—	Rambo (1954)*

\* Studies comprising floristic surveys on more than just one study area.

**Figure 2.** Angiosperm plant families with the largest number of species in the *restingas* of Santa Isabel Biological Reserve, northern coast of Sergipe state.





**Figure 3.** Flowering plants in the *restingas* of Santa Isabel Biological Reserve, northern coast of Sergipe state, Brazil. **A:** *Centrosema brasilianum* (L.) Benth. **B:** *Byrsonima sericea* DC. **C:** *Nymphaea pulchella* DC. **D:** *Psittacanthus dichroos* (Mart.) Mart. **E:** *Tapirira guianensis* Aubl. **F:** *Stylosanthes viscosa* (L.) Sw. **G:** *Langsdorffia hypogaea* Mart. **H:** *Curatella americana* L. **I:** *Canavalia rosea* (Sw.) DC. **J:** *Bacopa monnieri* (L.) Wettst. **K:** *Pavonia humifusa* A. St - Hil. **L:** *Symphonia globulifera* L.f. (Photos: E.V.S. Oliveira).



with bacteria from genus *Rhizobium* of many species of Fabaceae species (Allen and Allen 1981) has helped plants of this family to establish on the dystrophic soil of *restingas*. An alternative explanation is the contribution given by elements from neighboring biomes, especially from *Mata Atlântica* (Rizzini 1997; Scarano 2002), where Fabaceae is the second most representative family (Stehmann et al. 2009).

The most representative genus, *Rhynchospora* Vahl, was the second most abundant genus in the flora of Sergipe *restingas* (Oliveira et al. 2014). This genus can be found in all Brazilian states and its species are herbs able to live in terrestrial, aquatic and rupicolous substrates (Alves 2014). Six out of the 15 *Rhynchospora* species yet recorded for the Brazilian *restingas* (Restinga Net 2015) were found, mainly those inhabiting open fields in demoted sites (flooded or non-flooded) or banks of permanent or temporary ponds.

Herbs are important to the flora of *restingas* in the Santa Isabel Biological Reserve because most of this protected area is covered by large areas of herbaceous vegetation types (Oliveira and Landim 2014). The herbaceous habit was also prominent in the *restingas* of Sergipe (Oliveira et al. 2014) and Ceará states (Santos-Filho et al. 2011; Matias and Nunes 2001). It shows the importance of pioneer species in *restinga* environments due to their adaptations to adverse local conditions. The low representation of climbers and epiphytes indicate a typical feature of the *restinga* environment (Santos-Filho et al. 2011; Almeida Jr. et al. 2007; Matias and Nunes 2001; Oliveira et al. 2014).

Finally, it is worthy to highlight the occurrence of *Myrcia ovina* Proença & Landim, which is a recently described species that had been previously collected solely in the state of Sergipe, in Pirambu and Japarutuba Counties (Proença et al. 2014). The species is apparently endemic to the Northeastern *restingas*. Further plant inventories are needed in order to improve our knowledge on its geographical range and, therefore, on its conservation status.

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